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TITLE OF INVENTION

Method of analysis of alcohol by mass spectrometry

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CLAIM LISTING

CLAIMS

We claim:

1. (Currently Amended) A method of synthesis of stable isotope internal standards and chemical reactions for the purpose of identification and quantification of [[alcohol(s)]] alcohols of the formulas ROH, wherein R is an alkyl, aryl, or heteroatom cyclic or non-cyclic group, in a sample comprising the steps of:

a) converting an authentic sample of said alcohols into stable isotope labeled internal standards of the formulas ROCOR', wherein R is an alkyl, aryl, or heteroatom cyclic or non-cyclic group, and R' is a stable isotope labeled alkyl or aminoalkyl group;

[[a]] b) combining a known amount of [[an ester]] said stable isotope labeled internal standards with said sample comprising said alcohols ;

[[b]] c) [[contacting]] converting said alcohols in said sample mixture ~~with an acid anhydride or an acid chloride to convert said alcohol in said sample~~ into [[an ester]] compounds of identical structure as [[that]] those of said [[ester]] stable isotope labeled internal standards except for the stable isotope atoms;

[[c]] d) [[extracting]] isolating said stable isotope labeled internal standards and said converted compounds in said sample ~~to isolate said ester and said ester internal standard by an aqueous extraction;~~ and

[[d]] e) analyzing said [[ester]] converted compounds and said [[ester]] stable isotope labeled internal standards by mass spectrometry.

2. (Currently Amended) The method of claim 1 wherein said mass spectrometric method is the [[isotope dilution]] mass spectrometric method using isotope labeled internal standards.
3. (Canceled) The method of claim 1 wherein said alcohol is an alcohol having the following formula R_1OH , R_1CH_2OH , R_1R_2CHOH , $R_1R_2R_3COH$, wherein R_1 , R_2 , and R_3 are alkyl, aryl, and heteroatom containing cyclic or non-cyclic groups .
4. (Canceled) The method of claim 1 wherein said ester internal standard is a stable isotope labeled internal standard.
5. (Currently Amended) The method of claim 1 wherein said [[ester]] stable isotope labeled internal standards [[is]] are synthesized by reacting an authentic sample of said alcohols with a stable isotope labeled acid anhydride or acid chloride or isocyanate reagent ~~to form said ester internal standard having the following formula R_1OCOR_4 or $R_1CH_2OCOR_4$ or $R_1R_2CHOCOR_4$ or $R_1R_2R_3OCOR_4$ wherein R_4 is a stable isotope labeled alkyl or aryl group.~~
6. (Currently Amended) The method of claim 5 wherein said stable isotope labeled [[group R_4]] acid anhydride or acid chloride or isocyanate reagent is selected from a group ~~consisting of CD_3 , CD_2CD_3 , and C_6D_5 , formed by reacting said alcohol with labeled acid anhydride selected from a group comprising of stable isotope labeled acetic acid anhydride, [[labeled]] propionic acid anhydride, [[and labeled]] benzoic acid anhydride, or labeled acid chloride selected from a group comprising labeled acetyl chloride, [[labeled]] propionyl chloride, [[and labeled]] benzoyl chloride, methyl isocyanate, ethyl isocyanate, and phenyl isocyanate.~~
7. (Currently Amended) The method of claim 1 wherein said aqueous extraction step [[c]] d) can be any appropriate separating method~~[[s]]~~ such as solid phase extraction, liquid-liquid extraction or solid supported liquid-liquid extraction method.

8. (Currently Amended) The method of claim 1 wherein said alcohols in said sample mixture are converted to compounds of identical struture as those of said stable isotope labeled internal standards, except for the stable isotope atoms, by reaction with an acid anhydride or acid chloride or isocyanate chemical reagent ~~is selected from a group consisting of acetic acid anhydride, propionic acid anhydride, and benzoic acid anhydride and said acid chloride is selected from a group consisting of acetyl chloride, propionyl chloride, and benzoyl chloride.~~
9. (Original) The method of claim 1 wherein said sample contains either a singularity or a plurality of alcohols.
10. (Currently Amended) The method of claim [[1]] 8 wherein said ~~multiple alcohols can be converted to said esters using either a single~~ acid anhydride or [a single] acid chloride or isocyanate chemical reagent is selected from a group comprising of acetic acid anhydride, propionic acid anhydride, benzoic acid anhydride, acetyl chloride, propionyl chloride, benzoyl chloride, methyl isocyanate, ethyl isocyanate, and phenyl isocyanate.
11. (Currently Amended) The method of claim 1 wherein said multiple stable isotope labeled [ester] internal standards can be synthesized from said alcohols using either a single stable isotope labeled acid anhydride or [[a single labeled]] acid chloride or isocyanate reagent.
12. (Currently Amended) The method of claim 1 wherein there is no conversion of said stable isotope labeled [ester] internal standards to [[its]] corresponding [[non-labeled ester]] converted compounds during step [[b]] c).
13. (Currently Amended) The method of claim 1 wherein said converting step [[b]] c) is performed in an aqueous environment.
14. (Currently Amended) The method of claim 1 wherein said converting step [[b]] c) is performed before said extraction step d).

15. (Currently Amended) The method of claim 1 wherein said converting step $[[b]]c$ is quantitative.

16. (Canceled) A method of identification and quantification of alcohol(s) in a sample comprising the steps of:

a) combining a known amount of a carbamate internal standard with said sample comprising said alcohol ;

b) contacting said sample with an isocyanate to convert said alcohol in said sample into a carbamate of identical structure as that of said carbamate internal standard except for the stable isotope atoms;

c) extracting said sample to isolate said carbamate and said carbamate internal standard; and

d) analyzing said carbamate and said carbamate internal standard by mass spectrometry.

17. (Canceled) The method of claim 16 wherein said mass spectrometric method is the isotope dilution mass spectrometric method using isotope labeled internal standard.

18. (Canceled) The method of claim 16 wherein said alcohol is an alcohol having the following formula R_1OH , R_1CH_2OH , R_1R_2CHOH , $R_1R_2R_3COH$, wherein R_1 , R_2 , and R_3 are alkyl, aryl, and heteroatom containing cyclic or non-cyclic groups.

19. (Canceled) The method of claim 16 wherein said carbamate internal standard is a stable isotope labeled internal standard.

20. (Canceled) The method of claim 16 wherein said carbamate internal standard is synthesized by reacting an authentic sample of said alcohol with a stable isotope labeled reagent to form said carbamate internal standard having the following formula R_1OCONR_4 or $R_1CH_2OCONR_4$ or $R_1R_2CHOCONR_4$ or $R_1R_2R_3COCONR_4$, where R_4 is a stable isotope labeled alkyl or aryl group.

21. (Canceled) The method of claim 20 wherein said labeled group R_4 is selected from a group consisting of CD_3 , CD_2CD_3 , and C_6D_5 , formed by reacting said alcohol with a labeled isocyanate selected from a group comprising labeled methyl isocyanate, labeled ethyl isocyanate, and labeled phenyl isocyanate.
22. (Canceled) The method of claim 16 wherein said extraction step c) can be any appropriate separating methods such as solid phase extraction, liquid-liquid extraction or solid supported liquid-liquid extraction.
23. (Canceled) The method of claim 16 wherein said isocyanate is selected from a group consisting of methyl isocyanate, ethyl isocyanate and phenyl isocyanate.
24. (Canceled) The method of claim 16 wherein said sample contains either a singularity or a plurality of alcohols.
25. (Canceled) The method of claim 16 wherein said multiple alcohols can be converted to said carbamates using a single isocyanate.
26. (Canceled) The method of claim 16 wherein said multiple labeled carbamate internal standards can be synthesized from said alcohols using a single labeled isocyanate.
27. (Canceled) The method of claim 16 wherein there is no conversion of said stable isotope labeled carbamate internal standard to its corresponding non-labeled carbamate compound during said converting step b).
28. (Canceled) The method of claim 16 wherein said converting step b) is performed in an aqueous environment.
29. (Canceled) The method of claim 16 wherein said converting step b) is performed before said extraction step.
30. (Canceled) The method of claim 16 wherein said converting step b) is quantitative.